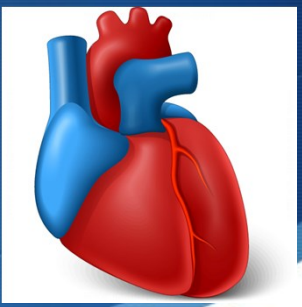
# Stabilization of the trauma patient

Armelle deLaforcade DVM, DACVECC

# Trauma Cases

- Decisions based on minimal information
- Quick action needed
- Index of suspicion
- Consequences
  - Non-existing vs. life-threatening
- Setting expectations

# General assessment

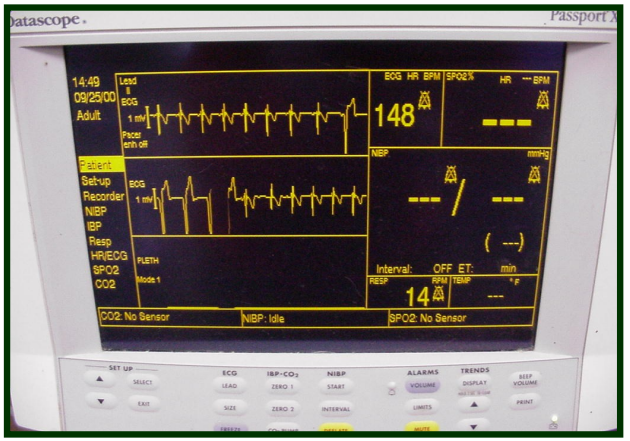


- Look for shock!
  - HR, CRT, lactate, mentation
  - Hypovolemia – relative vs. absolute
  - Blood pressure?
  - Femoral pulse quality?
  - Lactate

- Treat for shock
  - Large bore over-the-needle catheter
  - IVF: Crystalloids
    - LRS vs. 0.9% NaCl… does it matter?
  - Difficult to resuscitate? Colloids vs. hypertonic saline vs. blood

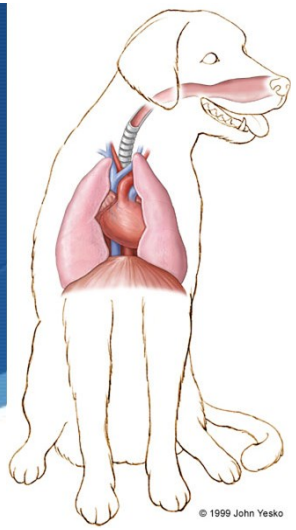
# During resuscitation

- ECG
  - Tachycardia: pain, shock
  - VPCs: pain, hypoxemia
- Flow by oxygen
  - Whatever is most comfortable
- Pain meds?
  - Methadone 0.1mg/kg IV
    - severe orthopedic injuries
  - Reversible, minimize sedation



# Index of suspicion

Common things happen commonly!




## Thoracic trauma

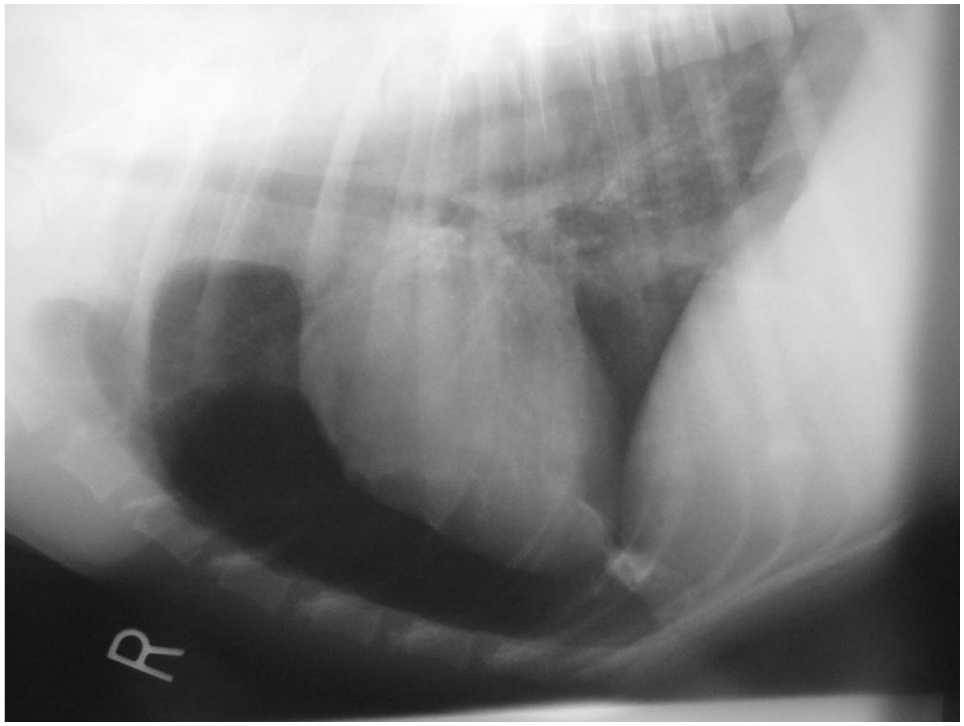
- Pneumothorax
- Pulmonary contusion
- Hemothorax?
- Penetrating wounds

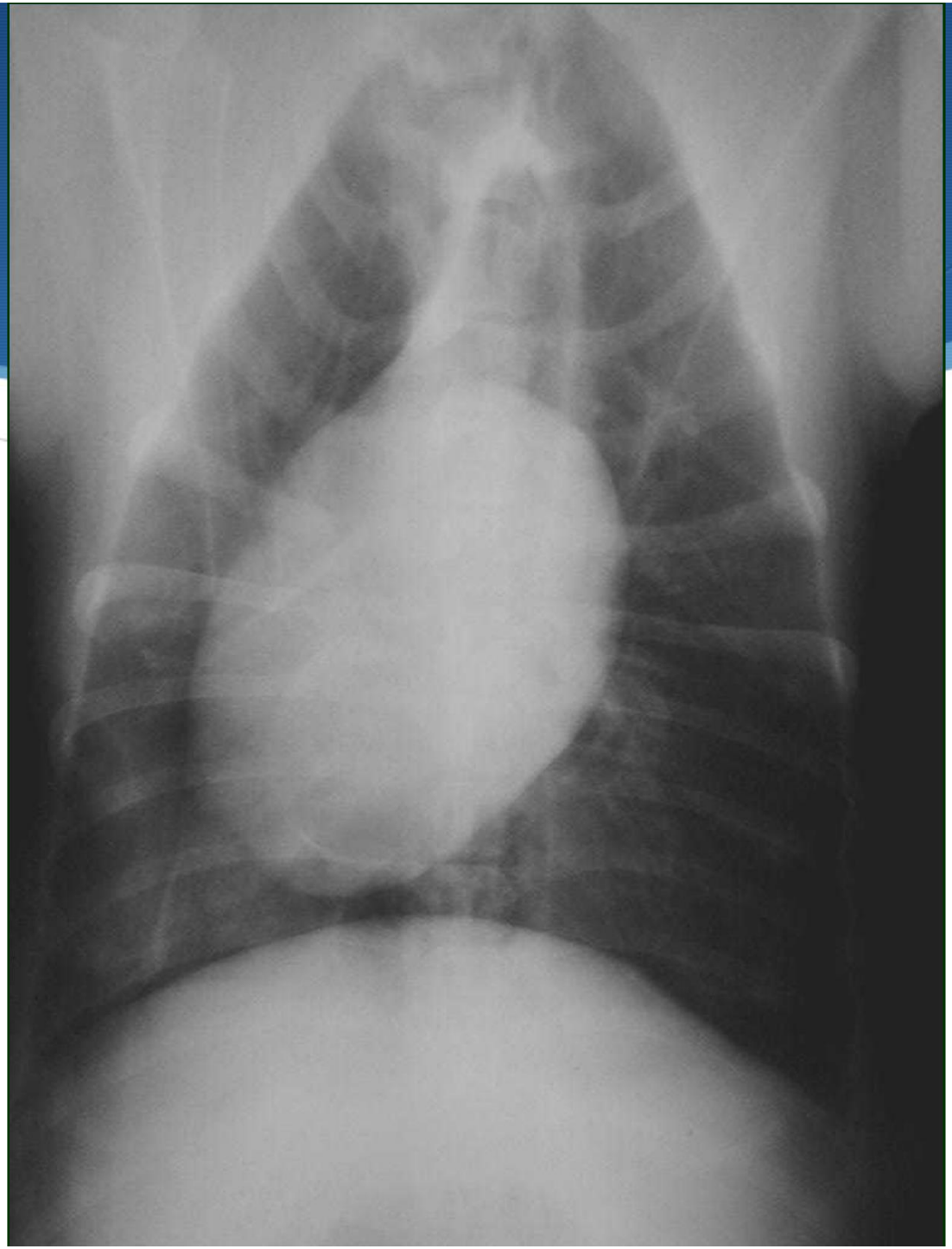
## Abdominal trauma

- Hemoperitoneum
- Diaphragmatic hernia
- Uroabdomen
- Penetrating wounds

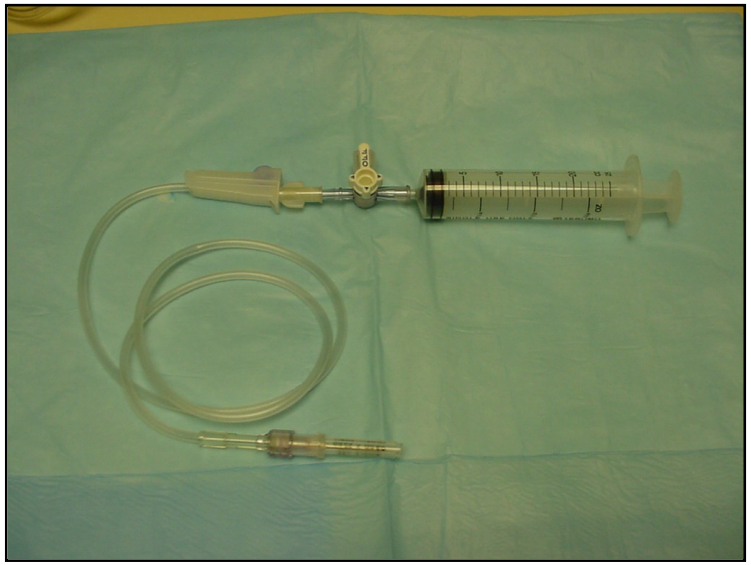
# Pneumothorax

- Common!
- ‘fish mouth’ breathing
- Tap prior to referral
- Indication for open-chest CPR
- Chest tube?
  - Continuous leak
  - 3 strikes and you are out!
  - Mila chest tube is fairly easy



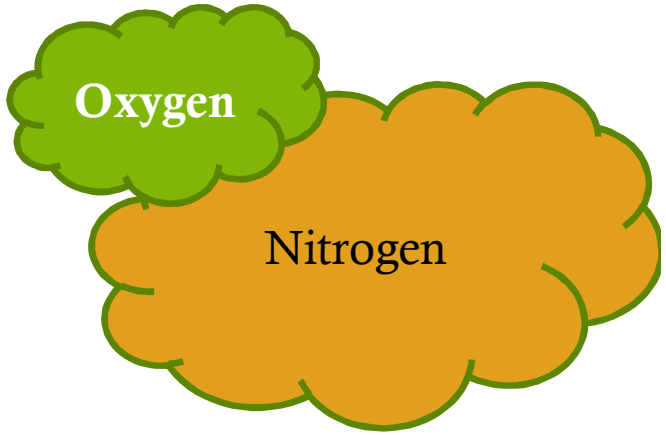


# Leo



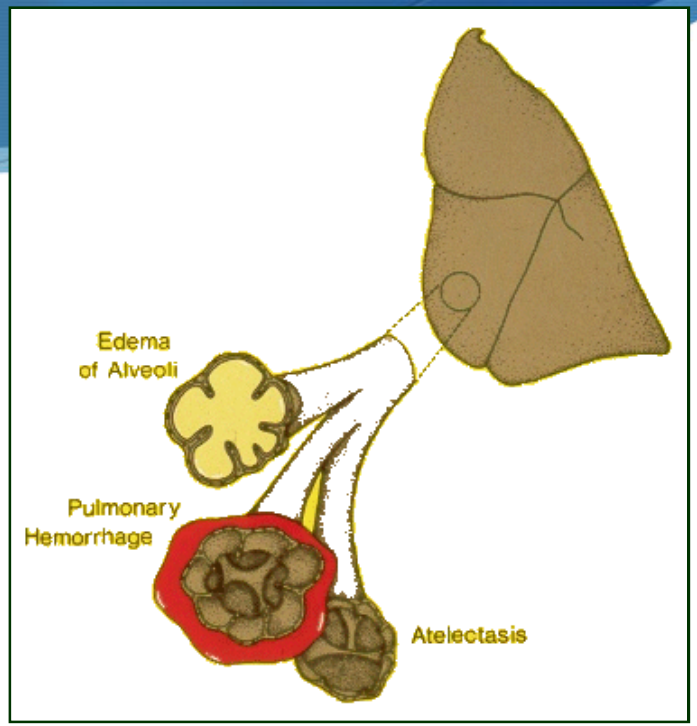
# Treatment

- If not short of breath… leave it alone!
  - Eventually seal – Tissue thromboplastin
- Oxygen therapy will help air be reabsorbed
- Be wary if needs anesthesia
  - Positive pressure ventilation

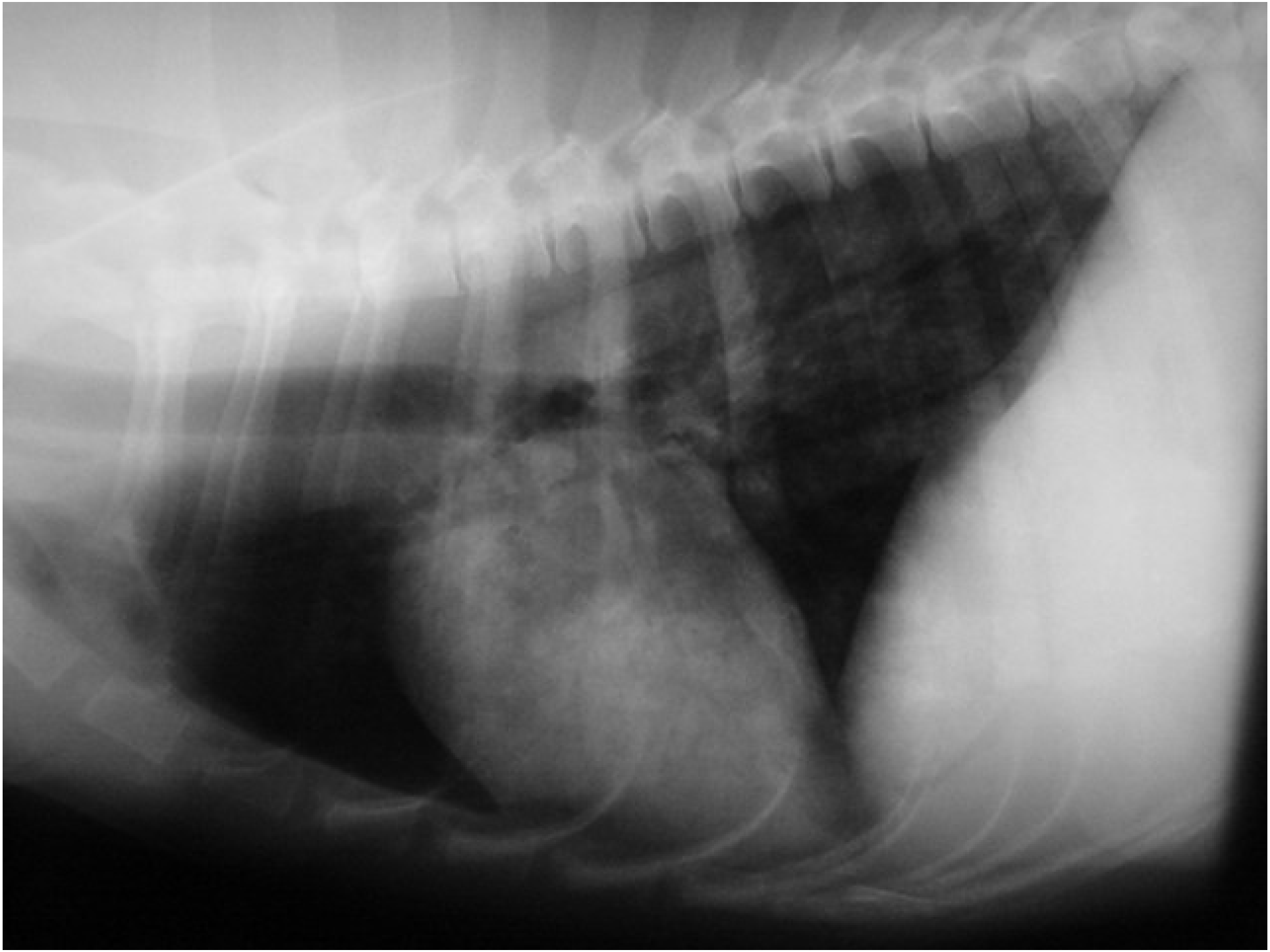


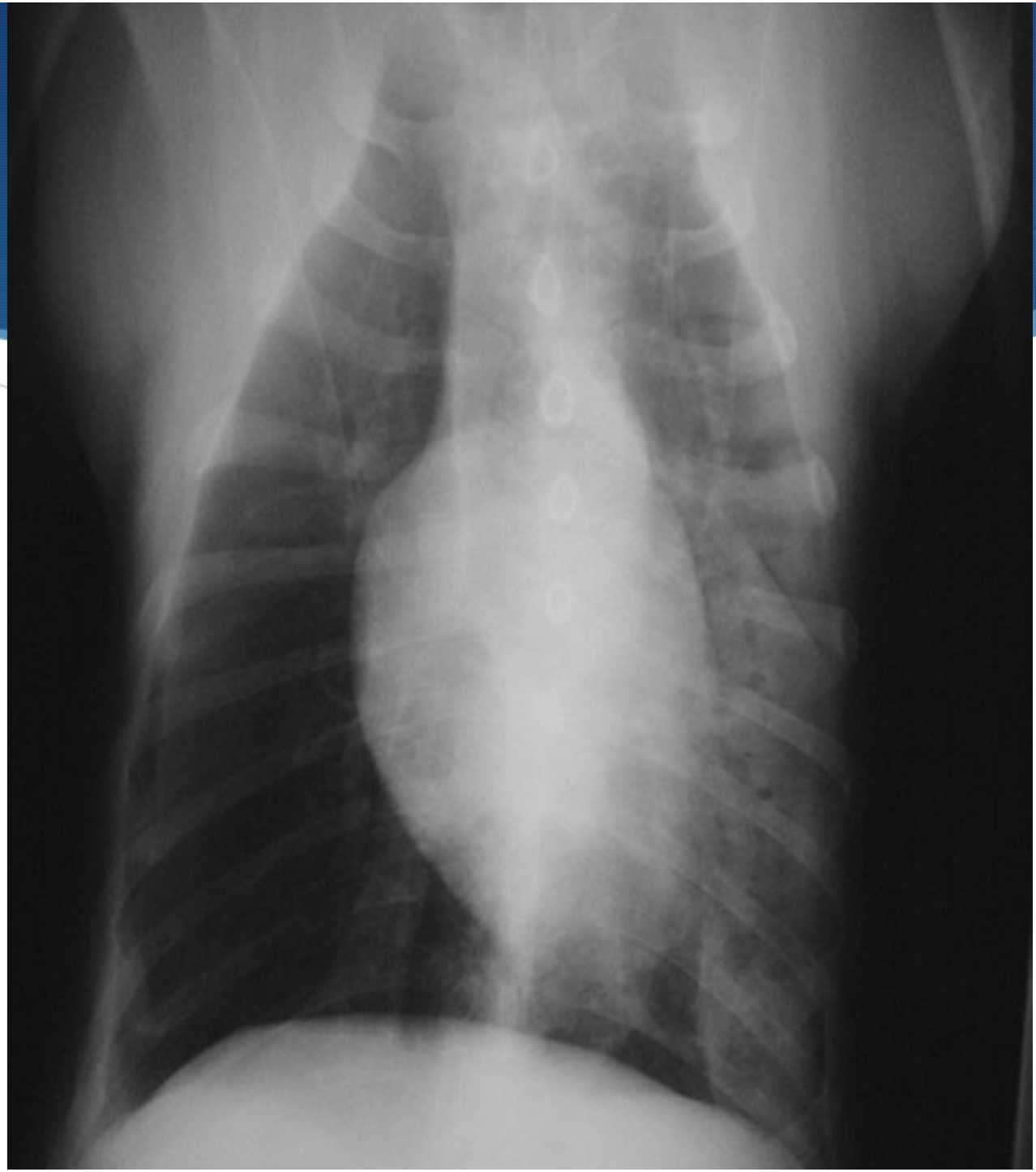
# Pulmonary contusion

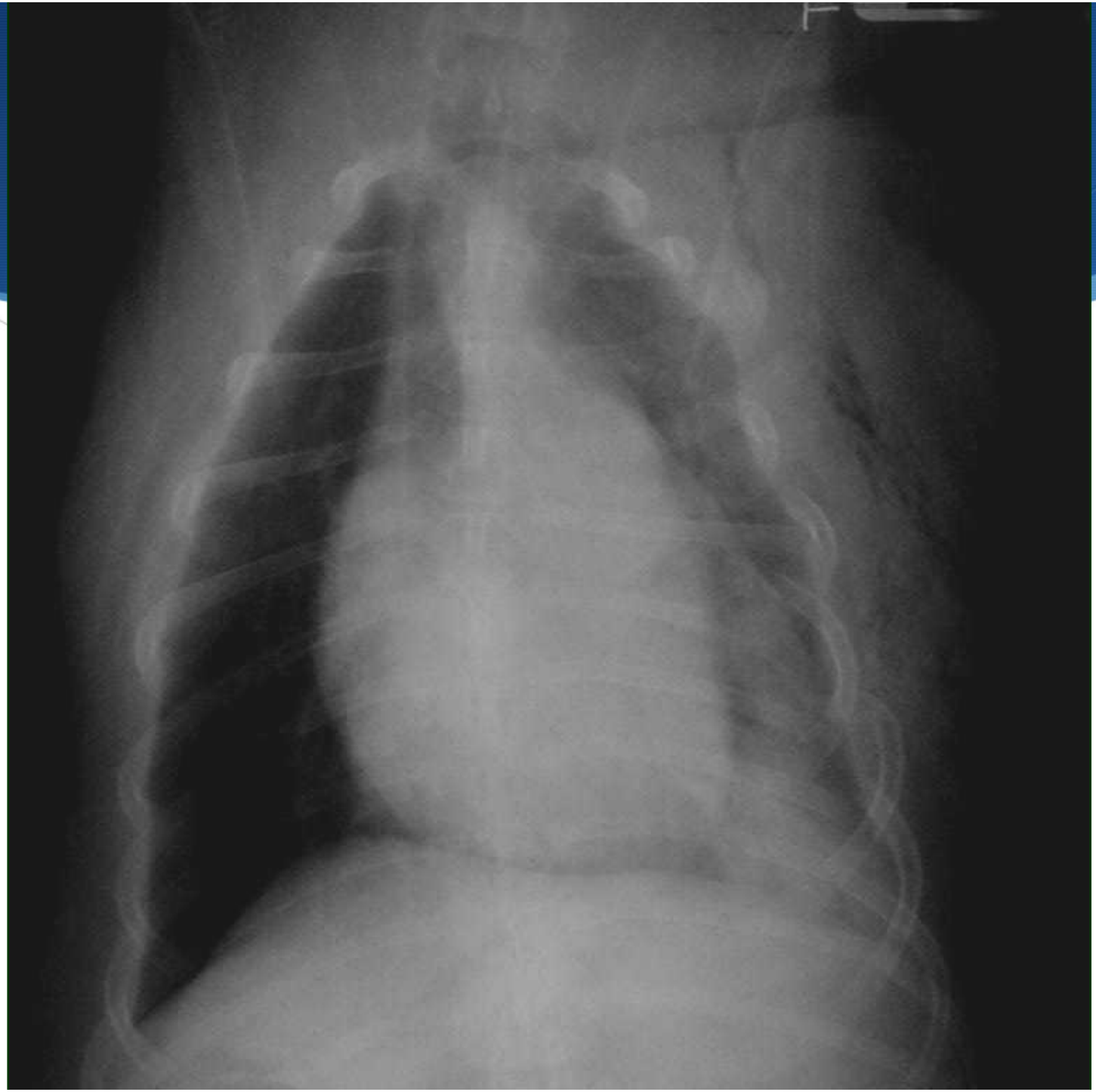
- Blunt force to lung parenchyma
- Early recognition!!
  - Harsh unilaterally
  - Hemoptysis
- Impact on fluid therapy decision!
- Antibiotics?
- Owner expectations
  - Get worse over 24-48 hrs?
  - Oxygen therapy? Ventilation?



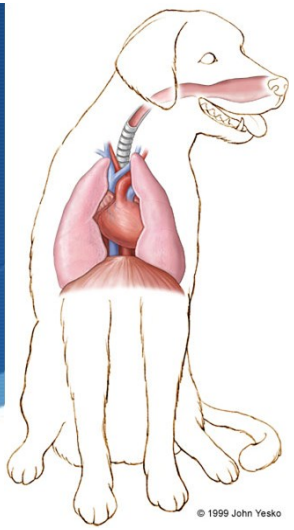

*Interstitial fluid*
*Alveolar fluid*
*Reduced compliance*
*Pulmonary shunting*







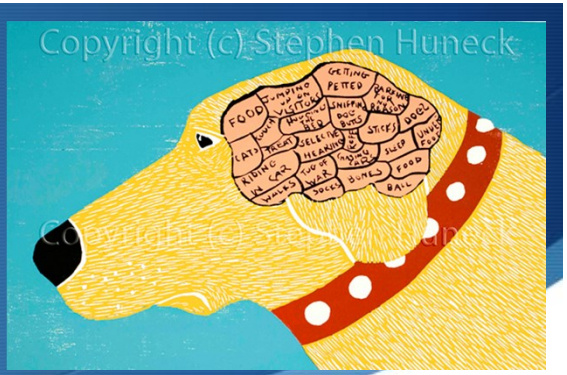
# Big time bottom line




- If critical, rule out pneumothorax first
- If needs to be intubated, avoid giving manual breaths!
- Fluids will make pulmonary contusion worse
  - Avoid big bolus
  - Titrate to PE and POC testing

# High flow oxygen therapy

# Head trauma




- More common in cats
- They look bad… but often get better
- Fluid therapy implications
  - Increased hydrostatic pressure worsens bleeding
  - Hypertonic saline 4ml/kg
  - Mannitol 1g/kg IV

# Diagnosis

- Anisocoria
- Scleral & oral hemorrhage
- Altered mentation
- Wounds

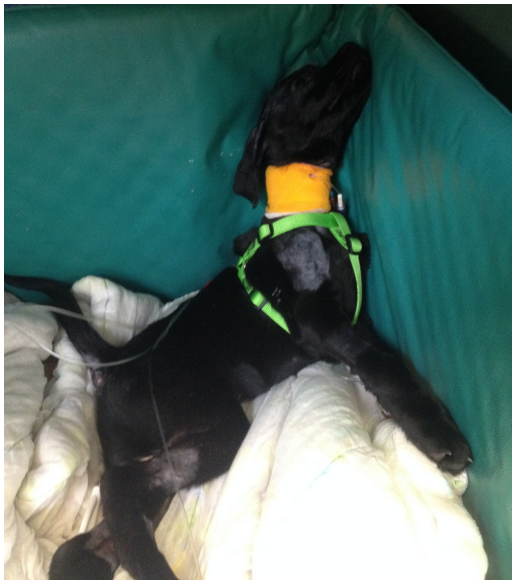
# Head trauma

CPP = MAP - ICP

- Pressure gradient driving cerebral blood flow
- Resistance of cerebral blood vessels changes to maintain CBF
- Autoregulation lost after head trauma
  - Brain depends on cerebral perfusion pressure for oxygen delivery
- Maintaining CPP is key in head trauma
  - No tolerance for hypotension
  - Treat suspected increases in intracranial pressure

# Head trauma: treatment

- Generally lower volume
  - Hypertonic saline, mannitol
- Ensure adequate airway
- If sedate, consider need for e-tube, assess jaw
- Trauma CT?
- Many do great
  - A few days, some longer



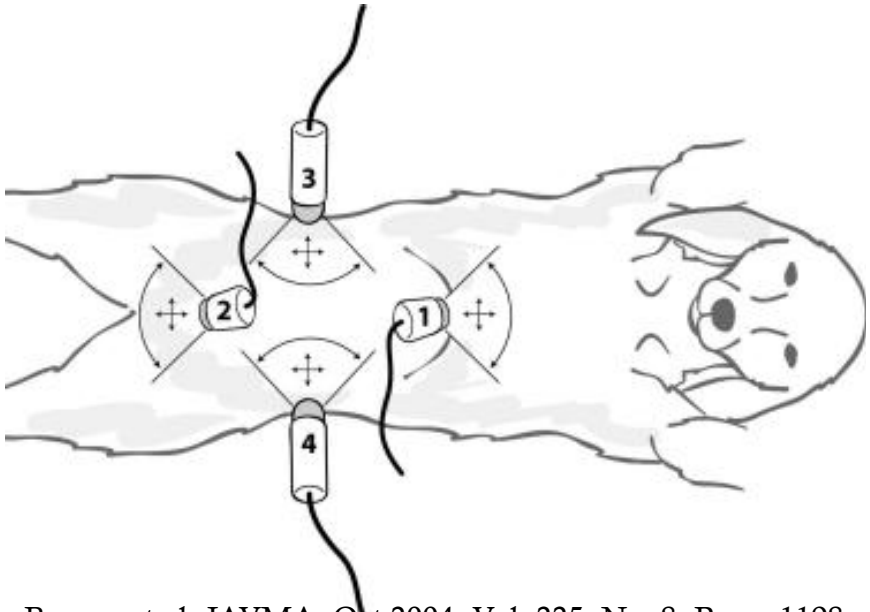
- Big time bottom line: can do surprisingly well

# Bleeding

- Important to recognize early
- May be difficult to detect
  - TS <6.0g/dl – suspect bleeding
- Hemoperitoneum – most common
- Other sources of bleeding
  - External
  - Long bone fractures
  - Pelvis

# Hemoperitoneum

- Roughly 45% of dogs hit by a car
- Diagnosis
  - AXR?
  - AFAST?
  - Abdominocentesis?




Boysen et al. JAVMA, Oct 2004, Vol. 225, No. 8, Pages 1198-1204

# Hemoperitoneum

- Rarely surgical
- Can be worsened by aggressive fluid therapy
  - Ovoid over-resuscitation
  - Endpoints of resuscitation: lactate, mentation
- Low volume resuscitation
  - Minimum systolic BP 90mmHg

# Coagulopathy?

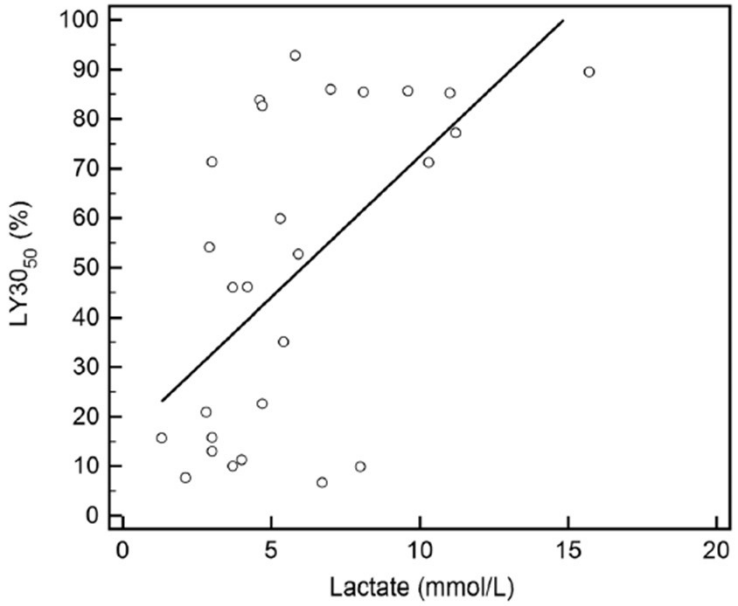
- Splenic / hepatic tear vs. coagulopathy
- Acute coagulopathy of trauma
- Fibrinolysis?

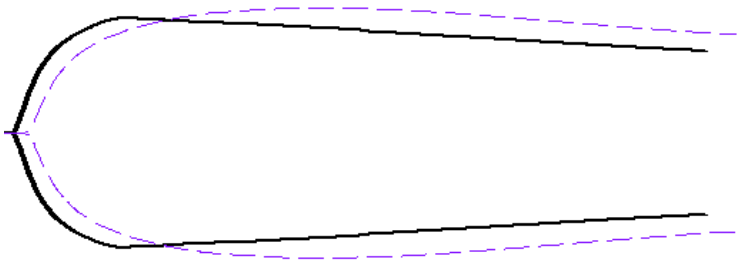
- Potential therapeutic target?
  - Aminocaproic acid
  - Tranexamic acid

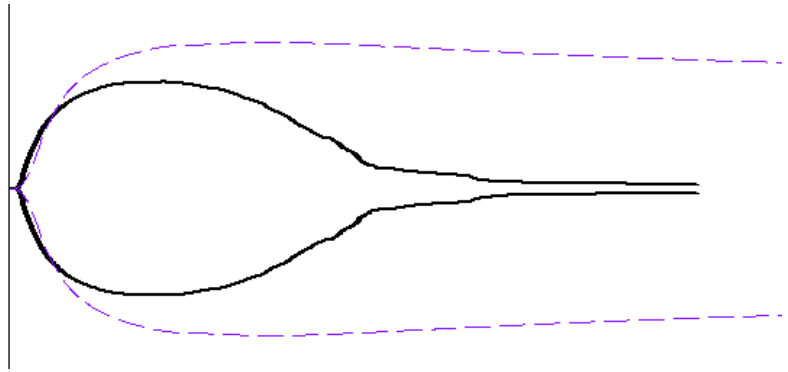
# Assessment of the relationships among coagulopathy, hyperfibrinolysis, plasma lactate, and protein C in dogs with spontaneous hemoperitoneum

Daniel J. Fletcher, PhD, DVM, DACVECC; Elizabeth A. Rozanski, DVM, DACVIM, DACVECC; Benjamin M. Brainard, VMD, DACVA, DACVECC; Armelle M. de Laforcade, DVM, DACVECC and Marjory B. Brooks, DVM, DACVIM

- Like trauma, tissue injury and hypoperfusion
- Likely at risk for hyperfibrinolysis



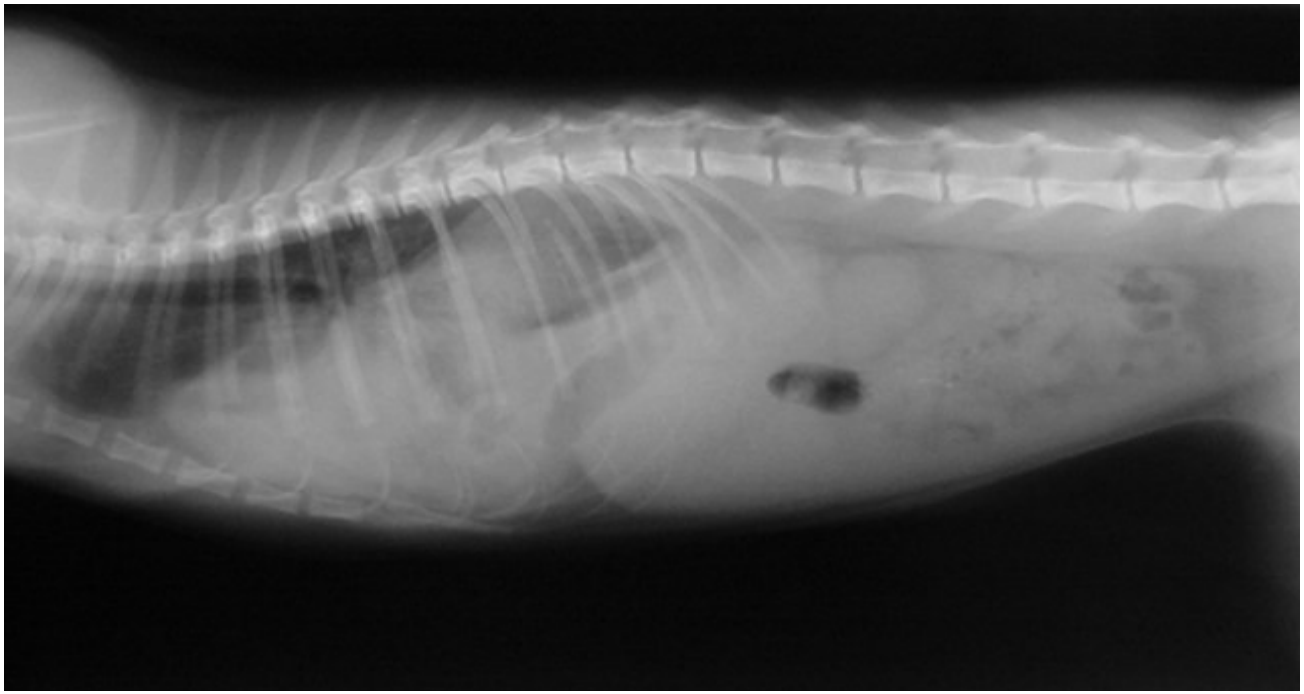


# Secondary survey

- Following assessment of heart, brain, lung
- Recognition of pulmonary contusion, hemoperitoneum
  - Direct impact on fluid therapy
- Fractures – long bone, spinal, ribs
- Penetrating injuries
- Diaphragmatic hernia
- Uroabdomen

# Diaphragmatic hernia

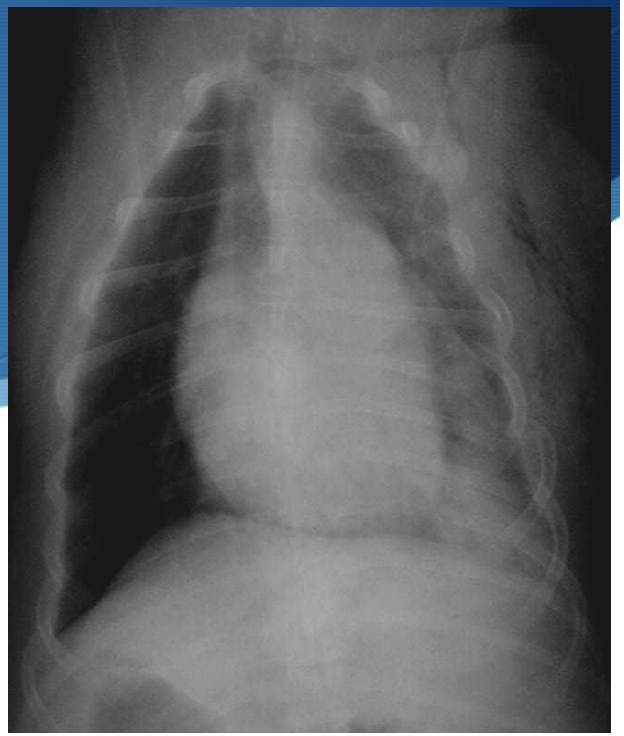
- Often undiagnosed for months
- Diagnosis can be challenging



# Diaphragmatic hernia

- Hypoventilation, hypoxemia
- Surgical disease but when?
  - Hernia contents
  - Concurrent injuries
  - Time of day – personnel
- Prognosis good
  - Perioperative period tricky
  - Chronic hernias do worse

# Rib fractures



- Indication of severe trauma
  - Contusion likely
  - Maybe pneumothorax
- Painful!
- Non surgical
  - Additional hospitalization

# Uroabdomen

- Less common than we think
- Low velocity injuries
  - Rolled over in driveway
  - Jump gone awry
- Diagnosis
- Surgical but non-emergent
  - Abdominal drainage
- Debate: need for contrast study prior to surgery?

# Fractures

- Costly!
- Financial constraints:
  - Cat: may get away with non-surgical management
  - Dogs: pelvic fractures may heal without surgery
- Source of blood loss
- Assume painful

# Spinal fractures

- Other injuries likely
- Intimidating
- PE
  - Motor? if present, good!
  - Deep pain? If present, good!
  - Withdrawal ≠ deep pain
- $$
  - No deep pain? Poor prognosis

# Penetrating injuries

- Often dramatic… distraction!

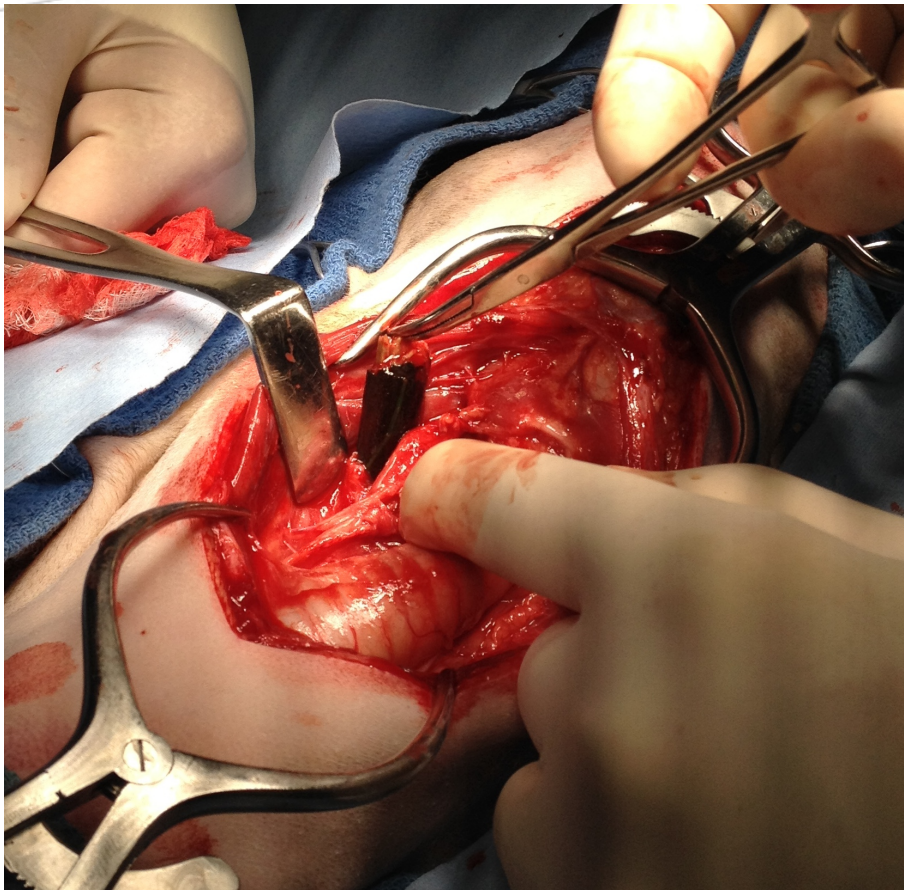
# Stick Impalement

- Most commonly sternal/axilla
- Small wound
- Often no clinical signs

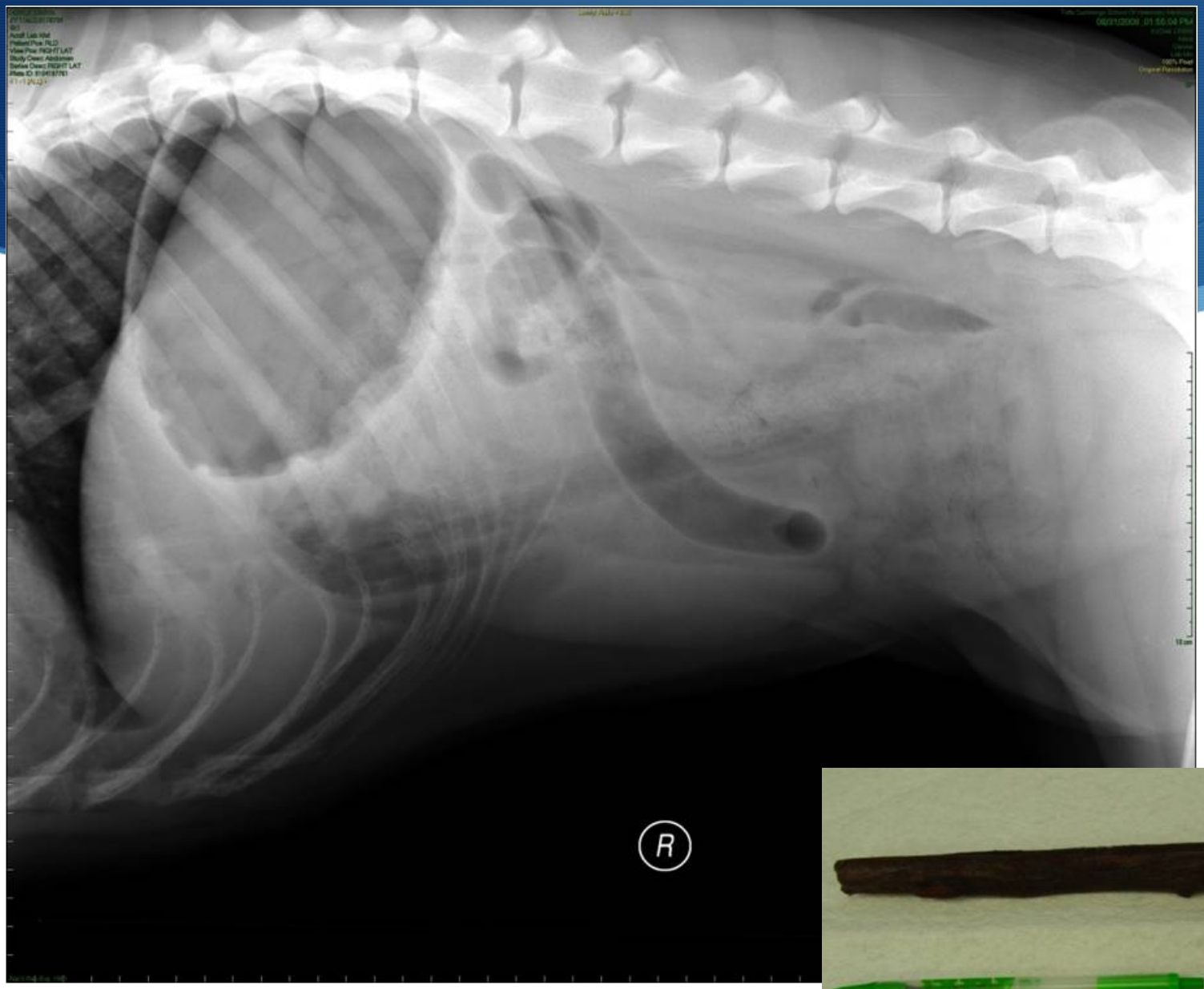
- Be wary….
- Resist the urge to ‘put a glove on and see’

# Stick Impalement

- ER vs OR?
- Control the airway
- Look for hemorrhage
- Get it all!
- Prepare owner
  - Simple wound
  - Thoracotomy
  - Abdominal explore
  - Both
- Prognosis: great



# Impalements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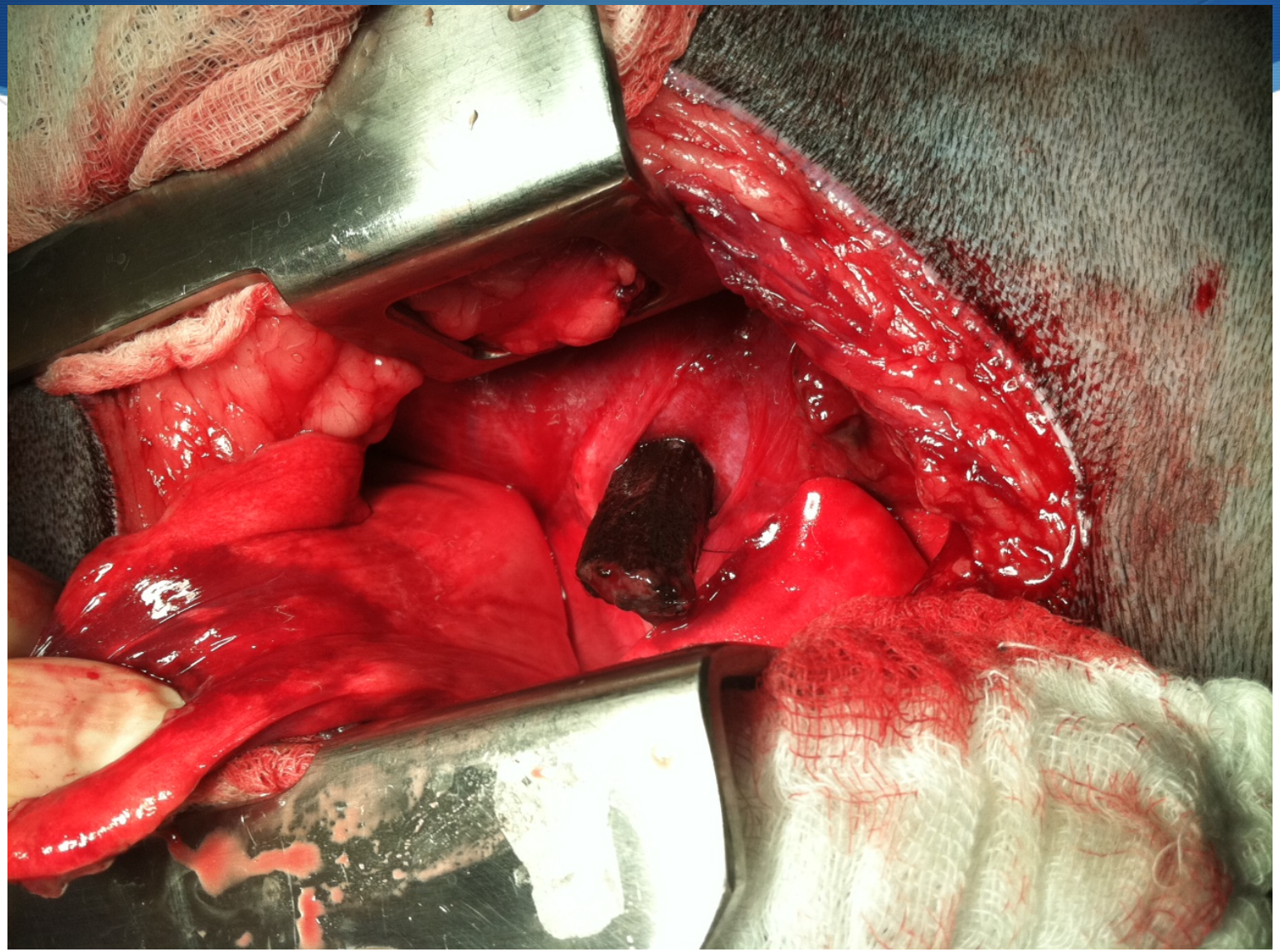
# To the OR!

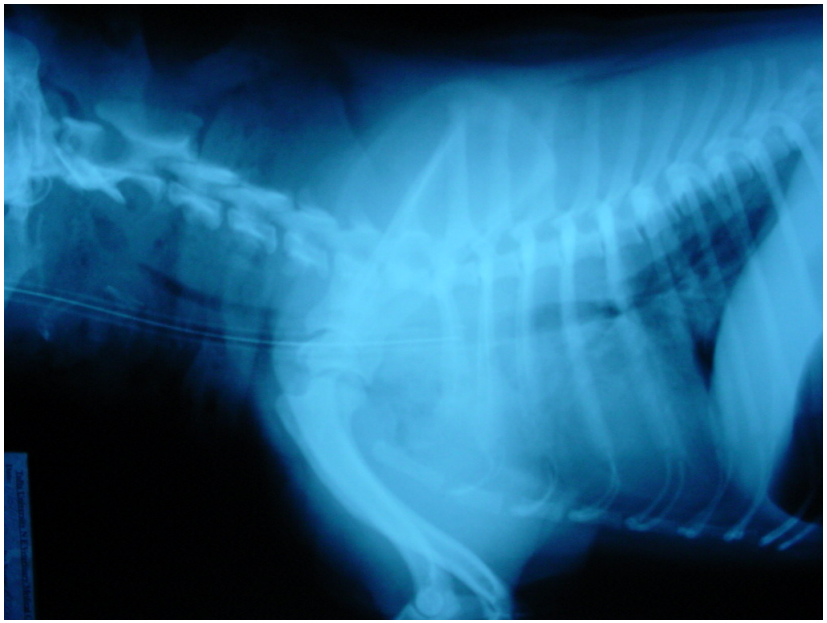


# Big time bottom line

- Don't be deceived by small wound
- Resist urge to 'put on a glove and see' until intubated
- Thoracotomy/explore needed to remove debris
  - Ensure no stick left behind

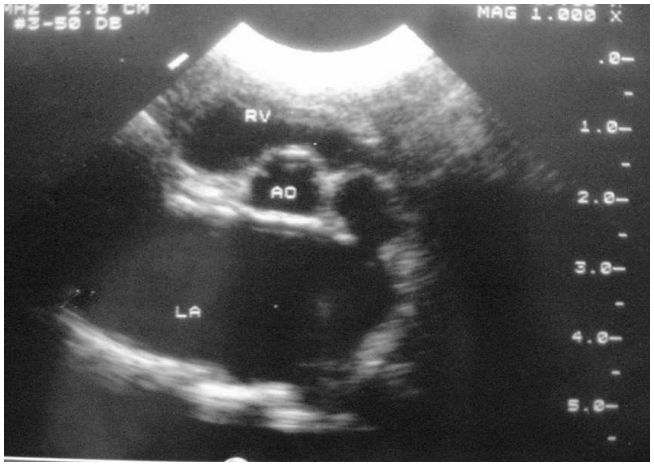
# Neck injuries

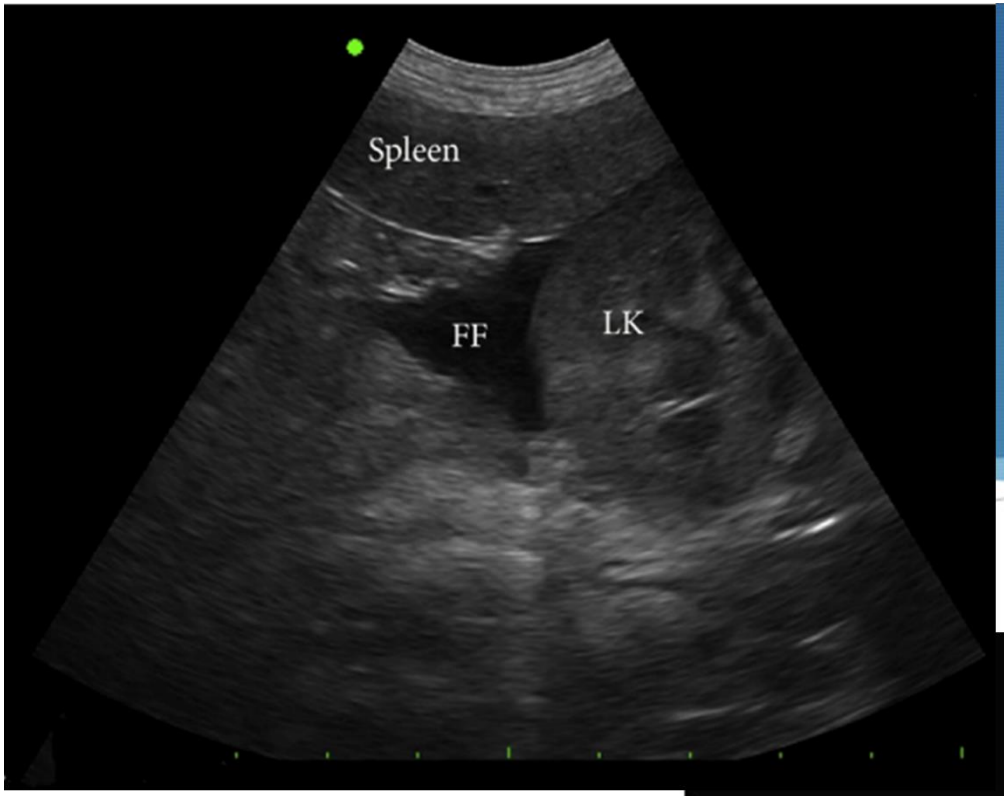
- Bite wounds
- Questionable thoracic involvement
- Laryngeal paralysis/collapse
- SQ emphysema
- LOUD sounds
- Take a look… after you intubate!



# AFAST & TFAST

- Rapid identification of effusion
  - Abdominal & pleural
  - Left atrial size?
- Pleural effusion: immediate results
  - Less stress
  - Guide therapy in dyspneic pets
- Abdominal effusion
  - Immediate results
  - Small volume effusion
  - In shocky animals, re-assess after resuscitation




Spleen
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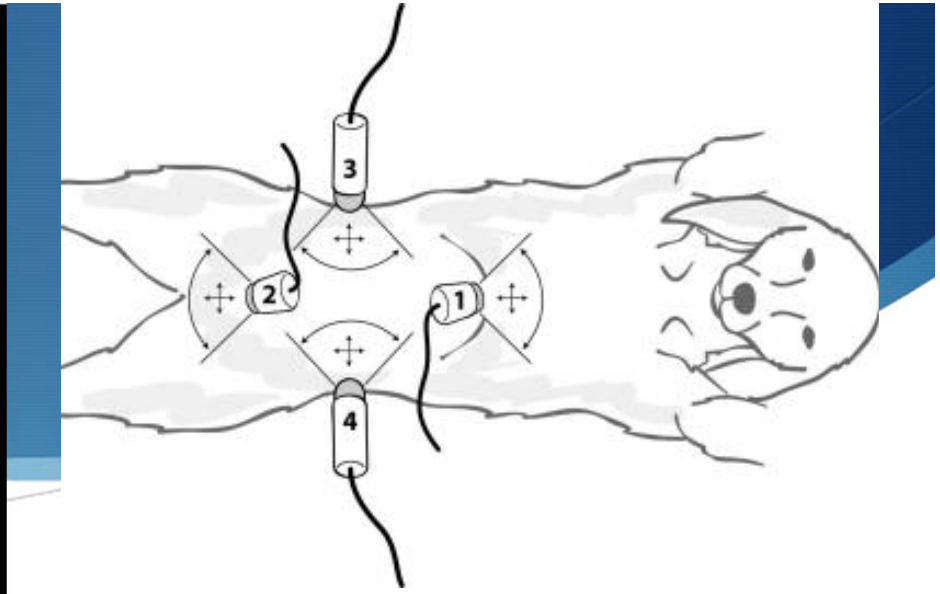
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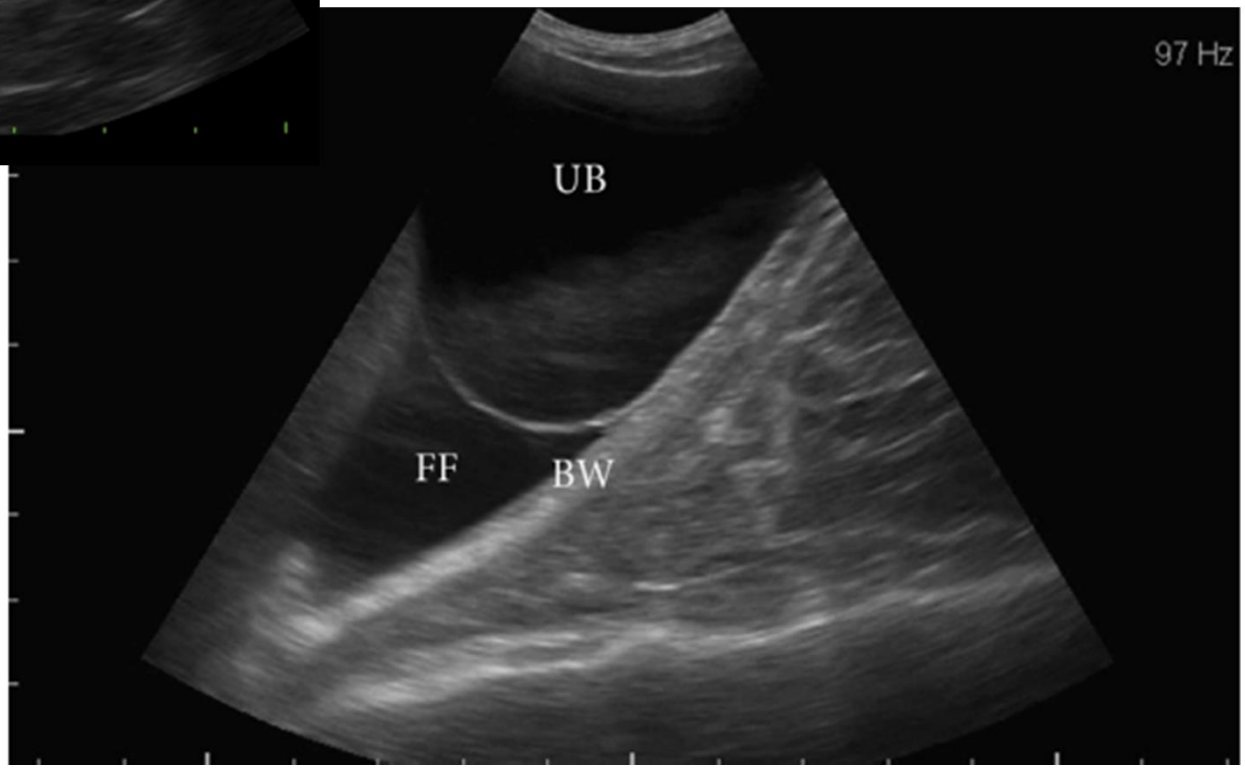
97 Hz
UB
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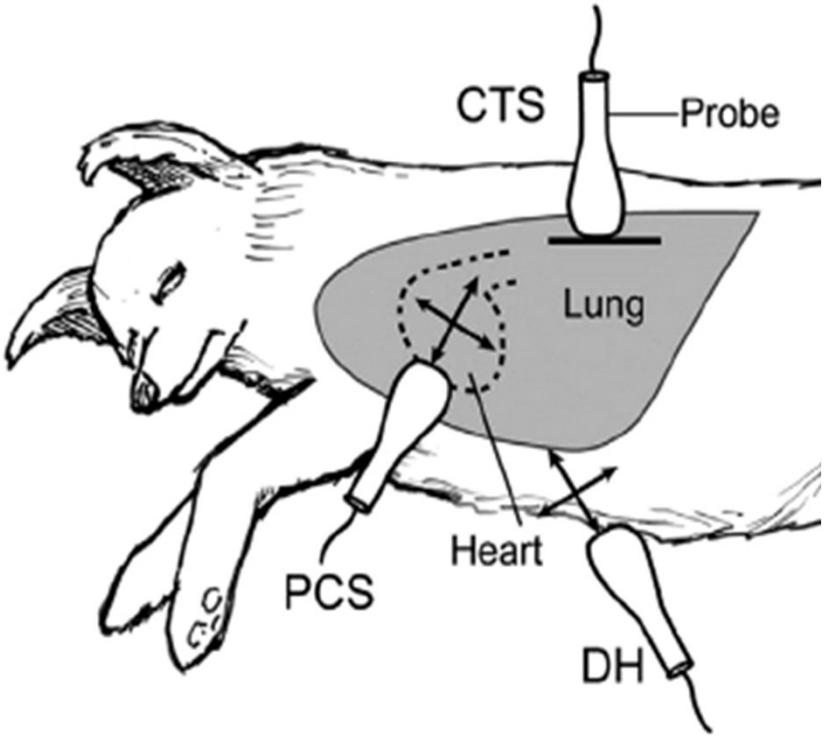
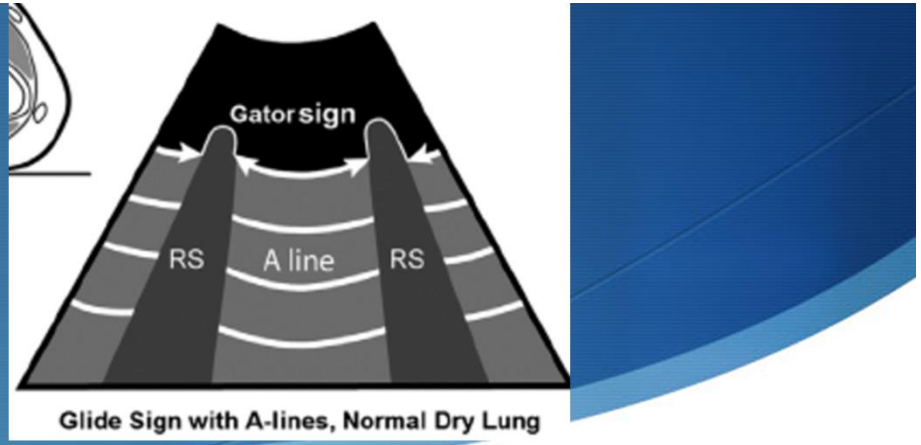
BW

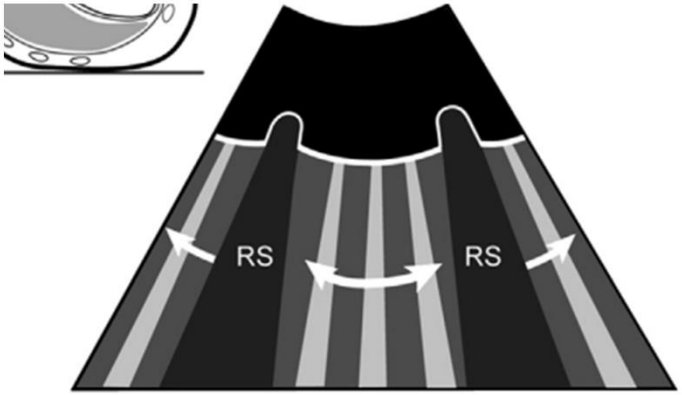
# VET BLUE

- Bedside lung ultrasound
- **Wet lung vs. dry lung
- Pulmonary contusion
- Pneumonia
- Cardiogenic pulmonary edema
- Pneumothorax




Glide Sign with A-lines, Normal Dry Lung



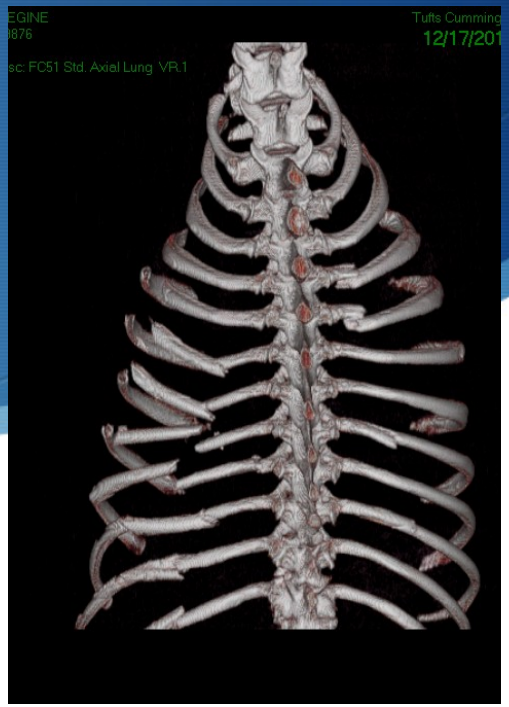

Ultrasound Lung Rockets, B-lines, Wet Lung


Gen THI
LT LUNG
16

# Lung ultrasound

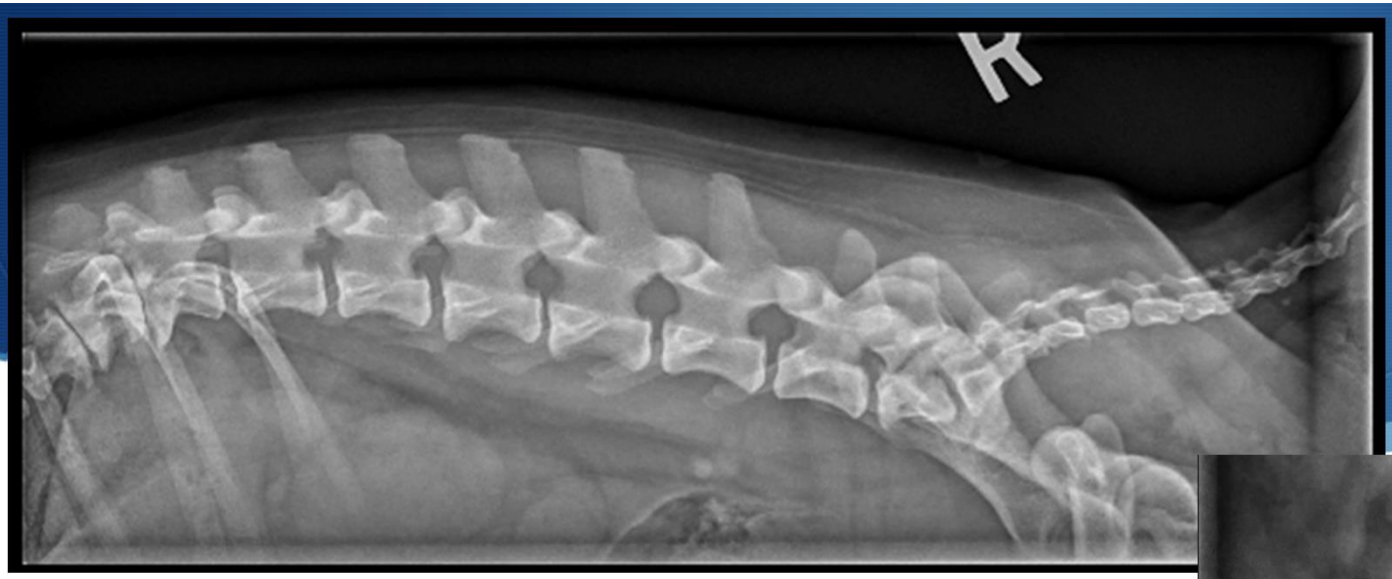
- TFAST: Is it much better than PE and radiographs?
  - Immediate results, ok to delay radiographs
  - Presence of effusion may impact decision to take radiographs
- VetBlue: Does it replace radiographs?
  - Likely not
  - False identification of B-lines
  - If many B lines and fits clinical picture, may treat
  - If results are focal or subtle, get films to confirm

# Trauma CT



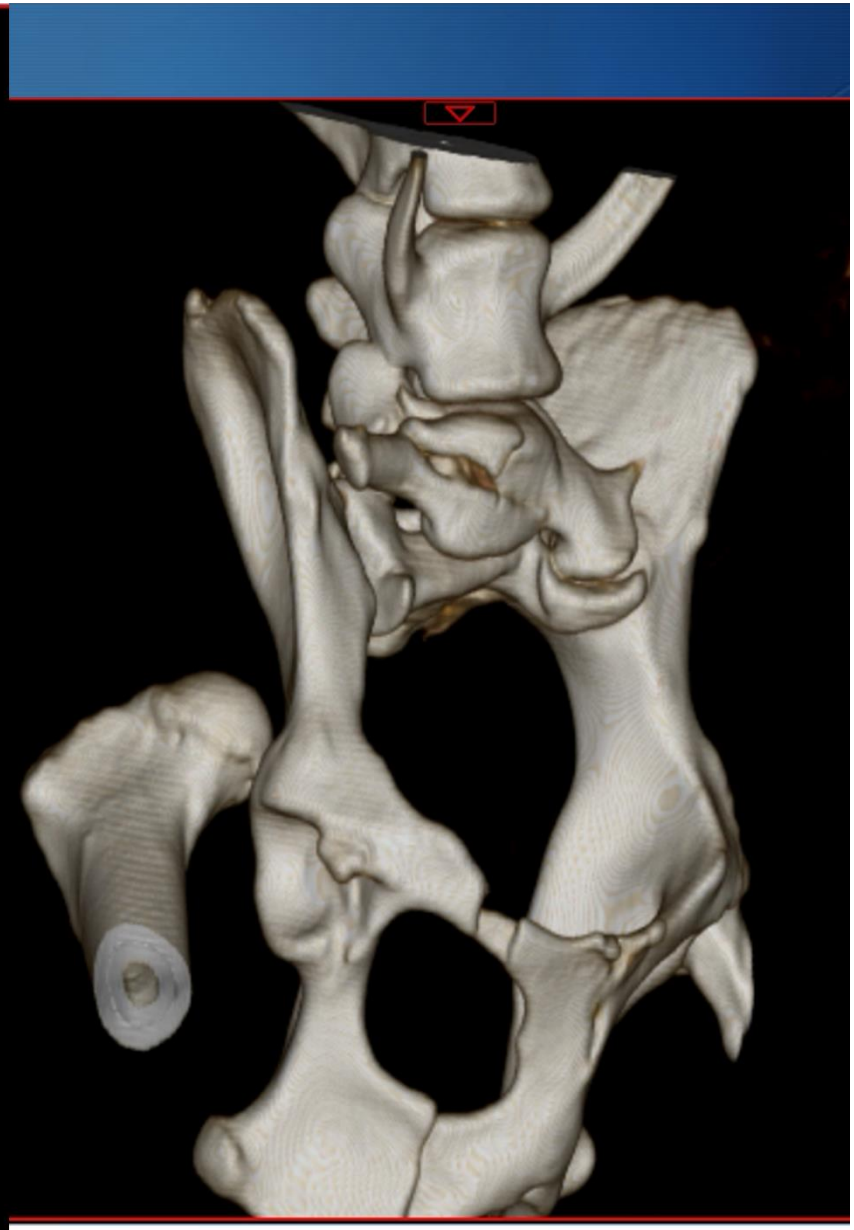

- Polytrauma
- Cost effective
  - Assess thorax, abdomen, extremities
  - Vs. cost of may radiographs
- Surgical planning

# Jackson

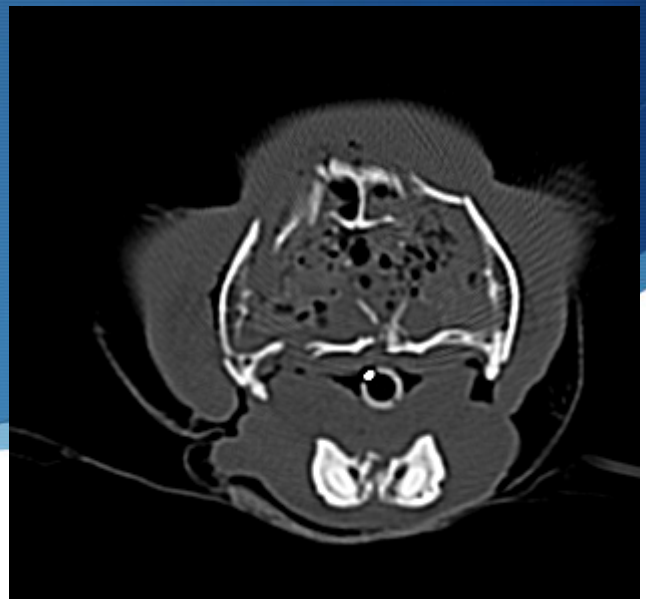


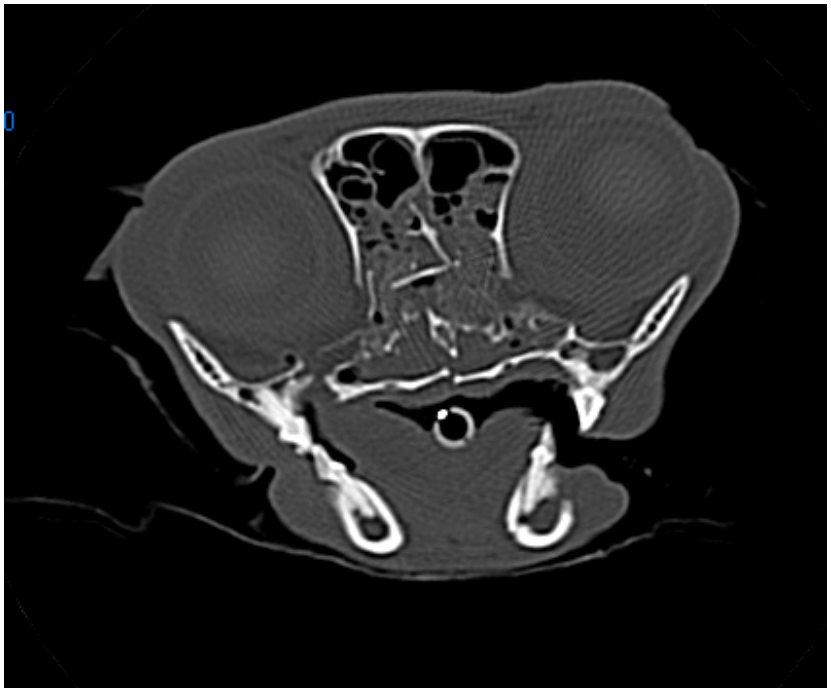


- Contusion
- Rib fracture
- Coxofemoral luxation
- SI luxation
- L7 fracture
- Pubic & ischiatic fractures



# Kebo





# Monitoring the trauma patient

- ECG – yes initially
- AFAST/TFAST – yes
- Lactate - yes
- Pulse ox – if breathing hard
- Blood gas – no
- End tidal CO2 – if intubated, and during CPR

# The next day?

- Analgesia
  - Opioids
  - Intercostal nerve blocks
  - Nocita if surgical
- Blood loss & intravascular volume
- ECG? Usually turned off

# Delayed injuries

- Uncommon

- Bile peritonitis
- Devitalized bowel

# Geriatric pets

- Co-morbidities!
- Roll-overs in driveway!
- Altered intent to treat
- Expect longer hospitalization

# Take home points

- Don't become overwhelmed by polytrauma
- Treat shock – Heart brain lung!
- Contusion or bleeding?
- Monitor  lactate, heart rate, mentation
- Pain meds and antibiotics
- Beware of being distracted by wounds, impalements
- Severe poly trauma is often fixable, needs time
- $$

# Questions?


Armelle.Delaforcade@tufts.edu